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tific work in agricultural science, and will not include the results of the ordinary trial of manures and varieties for demonstration or commercial purpose. It is proposed to issue the journal as material accumulates, aiming at quarterly parts of about 100 royal 8vo pages, four parts to constitute a volume. Among those who have promised to support the journal are: Professor H. E. Armstrong, F.R.S., Professor M. J. R. Dunstan, Dr. Bernard Dyer, Professor Liveing, Mr. A. E. Shipley, Dr. J. Augustus Voelcker, and Professor Marshall Ward. The first number will be published in January, 1905.

SOCIETIES AND ACADEMIES.

PHILOSOPHICAL SOCIETY OF WASHINGTON.

THE 589th regular meeting was held October 29.

Father Hagen, of the Georgetown Observatory, gave an account of 'Astronomy and Mathematics at the International Congress of Arts and Science,' speaking of the papers read, the persons present, the exhibits in various parts of the grounds and the formal and informal gatherings. Two great European congresses held just previous to that at St. Louis kept away many of the expected visitors.

Mr. C. E. Van Orstrand, of the Geological Survey, then presented a paper on 'A Load-Strain Function for Finite Strains.' The results of numerous experiments were summarized as showing that the load-strain curve is in general convex to the axis of loads, although in some instances there is one point of inflexion. Since matter is indestructible, the ordinates of the curve between the points of rupture for tension (x_t) and compression (x_c) are necessarily finite and positive. Hence the load-strain function can contain no zeros and no negative values between the limits x_c and x_t . There is a point of discontinuity at x_t , and for certain substances there may also be a point of discontinuity at x_c . Functions satisfying these conditions were defined by means of the function-theory. A special form of the most general equation is

$$y = (be^{c(x_t-x)^n} + k) - p,$$

where y = strained length and x = applied load.

For the case of perfect elasticity, $x_t = +\infty$, and a particular form of the equation is

$$y = e^{cx},$$

a relation which has previously been deduced, but by a wholly different method.* It was shown that this equation represents the data of observation to a high degree of accuracy within the limits ordinarily defined as perfectly elastic. The materials selected were vulcanized India rubber† and various kinds of metallic wires.‡

A letter from Dr. Becker was read expressing his appreciation of Mr. Van Orstrand's investigation.

Mr. C. W. Waidner, of the Bureau of Standards, gave the results of numerous determinations by himself and Mr. G. K. Burgess, of 'The Temperature of the Electric Arc.' A photometric method was used based on Wien's law and the instruments were calibrated at higher temperatures than had been done heretofore, so the uncertainty from extrapolation was reduced; the results were very accordant and gave about 3700° C. An increase of 70° to 80° was found when the current forming the arc was raised from 15 to 30 amperes.

CHARLES K. WEAD.

THE GEOLOGICAL SOCIETY OF WASHINGTON.

THE 158th meeting of the Society on November 9 had the following regular program:

Mr. S. F. Emmons spoke of copper ores in Carboniferous limestone in the region of the Grand Canyon of the Colorado, some of which he had an opportunity of visiting during the past summer. Their origin had been ascribed to the leaching of the copper from the red sandstones which once overlay them but are now eroded away. He used these occurrences as a text to discuss the general question as to whether the widespread occurrences of copper in the Permian and

* 'The Finite Elastic Stress-Strain Function,' Dr. George F. Becker, *Am. Jour. Sci.*, 1893.

† Watertown, 'Tests of Metals,' 1893.

‡ 'Ueber das Gesetz der elastischen Dehnung,' J. O. Thomson, *Ann. d. Phys.*, 3, 1891.

Triassic beds may be more properly considered as of contemporaneous formation with the enclosing beds, or whether they are later concentrations or may have been brought in from some entirely foreign source.

Dilation Fissures and Their Contained Ores.

MR. W. H. WEED.

Dilation fissures are the fractures formed by expansion or dilation of a rock mass, as in the alteration of peridotite or other basic rocks to serpentine, a change involving an increase of volume of 20 to 33 per cent. The resulting rock is checked by minor fissures, and often accompanied by crushed areas and by larger fractures with persistent course, slickensided walls and polished balls and shelly serpentine. The lesser fractures extend to relatively shallow depths. The larger are trunk channels for circulating waters. Serpentinization appears to be due to deep-seated ascending waters. Chromite, various nickel ores, and in Italy and Cuba, copper ores (chalcopyrite and pyrrhotite) known to exist in small quantity in the unaltered rock, are presumably dissolved by serpentinization processes and deposited by filling and replacement along the fissures and crushed masses, forming ore deposits.

Evidence of Caves of Put-in-Bay, Ohio, on Question of Land Tilting. MR. M. L. FULLER.

The caves of Put-in-Bay have been long known to the public, but, with the exception of Mr. E. L. Mosely, no one seems to have discussed the evidences which they present as to recent changes of lake level. Daussa's Cave is probably the one which Mosely visited. In this cave there is an underground lake 80 feet long and 40 feet wide, which is connected with and fluctuates with the waters of Lake Erie. The water is several feet deep and on the bottom may be seen a number of stalagmites, mostly broken and discolored as if of considerable age. These submerged stalagmites, which are of open air formation, indicate a rise of the lake water level relative to the land. Three other caves, Perry, Crystal and Paradise were visited during the past summer. Perry Cave is a solution cav-

ern, notable for its broad, low arch, 200 feet or more in diameter, and 5 to 7 feet high. Crystal Cave is an immense geode, 10 to 15 feet in diameter, lined with crystals of celestite up to a foot or more across. Neither of the caves throw much, if any, light on the problems of change of level. In Paradise Cave, however, which has been only recently opened, the stalactites are still preserved and afford more definite evidences. In this cave the stalactites, which are still dripping, are pendant from a sloping roof which dips beneath the surface of an underground lake connected with Lake Erie. There is no break in the stalactitic group between the portions above and below water level, indicating them to be essentially contemporaneous. The fact that those beneath the water level are practically as long as those above would indicate that the submergence was of so recent date that no material addition has taken place to those in the open air since the change of level. The submergence of the stalactites simply indicates a change of level of the lake waters relative to the land and does not in itself afford positive evidence of tilting. The occurrence of submerged tree stumps and other accordant evidences, all testifying to a similar change of level, seem to point to the tilting movement, established by Gilbert as a little less than half a foot to a hundred miles per century, as the cause of the submergence indicated by the stalactites of the caves.

GEO. OTIS SMITH,
Secretary.

BIOLOGICAL SOCIETY OF WASHINGTON.

THE 389th regular meeting of the society was held on Saturday evening, October 22, 1904. The following communications were presented:

The Insect-Catching Grass of Cuba. E. A. SCHWARZ.

With the beginning of the rains in Cuba, countless swarms of insects appear. At this time also, a grass becomes common, which catches multitudes of the insects in its flowering spikes. They are caught day and night, and in incredible numbers.

The spiny involucre of the spikelets of the

grass presents a bristling array to all comers. Wings of insects alighting or flying within reach are pierced and entangled by the minutely barbed spines and become inextricably matted. Sometimes an insect is caught by the leg. It is not the weak insects only which are caught. Numbers were caught of *Pyrophorus noctilucus* Linn., a luminous snapping beetle, so large and strong that it can be held in the hand with difficulty. While most insects can not free themselves once they alight on this grass, two large ones do so with impunity, an earwig, *Apterygida linearis* Esch., and a bug, *Œbalus*. Minute insects are not caught, and no Orthoptera or Lepidoptera. There seems to be no possible advantage to the grass in its capture of insects.

The grass is *Cenchrus echinatus* Linn., a great pest in the rich soils along the edges of sugar cane fields. It is found in the West Indies and in southern Florida.

A Very Curious Plant from Mexico. J. N. ROSE.

The plant in question is a large pumpkin-shaped object, or giant puff ball, somewhat flattened, with the bark of an oak. A few weak roots from the under side form a connection with the ground. The upper surface has a few groups of crowded stems which bear a few linear leaves. A broken specimen shows the interior to consist of a very pithy tissue, with a few roots traversing it from the clusters of stems above to the point of exit below.

Portions of the corky layer were submitted to various experts who could not agree as to whether it was of fungus origin, or caused or made by the insects inhabiting it. It is, however, probably not of pathological origin.

The plant is evidently of the lily family, genus *Nolina*, possibly species *humilis*. It is commonly called by the Mexicans 'palma.'

The Segregation of Fresh-Water Fishes. THEO. GILL.

One of the most remarkable facts in paleontology is the abruptness of the appearance of many families of fishes and especially of the fresh-water families of the great group of ostariophysans. This group or superorder

contains the orders of Plectospondyles and Nematognaths. It is only within a little more than a decade that the relations of their families have been recognized, the plectospondyle families having been previously widely dispersed, the cyprinids and three related families having been placed in one section, the charocinids and erythrinids next to the salmonids, and the electrical eel and gymnotids next to the eels. Now, all these forms as well as the nematognaths or catfishes have practically no paleontological history, the earliest known, *Bucklandium* of the Eocene, being evidently a true silurid in a restricted sense. There are no intermediate forms, no generalized types known. When and how did they originate?

Both the Plectospondyles and Nematognaths are more diversely represented in South America than elsewhere and it appears to be most probable that the ancestral forms were developed in what is now South America or in regions of the southern hemisphere lost in the waters of the Pacific or Atlantic. The origin may have commenced as far back even as the Devonian period. It may be recalled that ceratodontids are so closely related to recent forms that for a long time they were combined in the same genus and that no remains of species have been found in beds between the Jurassic and Pliocene Tertiary. What is true of ceratodontids may be true of other fishes.

The salt-water catfishes must be regarded as estrays from the fresh-water types that have accommodated themselves to new conditions.

The Exhibit of Living Animals at the St. Louis Exposition. A. B. BAKER.

More effort was made to exhibit living animals at the St. Louis Exposition than at previous expositions. The National Zoological Park of Washington made a particularly good display of birds in a large cage divided into two compartments, one for land birds and the smaller water birds, and the other for the large water birds.

The exhibit was largely an experiment, as it was not known whether so many birds could be displayed on so large a scale. It was a success, however, the mortality, even among

the small birds, being very low. The public interest was very great.

The fish exhibit was large. Some difficulty was experienced at first in using water that had been chemically treated to render it clear. Harm to the exhibit was avoided by adopting a closed water supply.

The 390th regular meeting of the society was held on Saturday evening, November 5, 1904. Dr. C. W. Stiles spoke briefly of the meeting of the International Committee on Zoological Nomenclature which was held in Berne during the past summer. He stated that the International Code of Nomenclature had been revised only editorially. It is now in press in France and will appear soon in English, French and German.

General T. E. Wilcox, U.S.A., presented an illustrated lecture on 'The Flora of the Western United States and Alaska.' He discussed particularly the plants of parts of the Rio Grande Valley and southeastern Arizona. Incidents of a long period of observation were related and the peculiarities of various desert plants mentioned. Especial reference was made to the effects of aridity, irregularity of rainfall and rapid evaporation. Medicinal and otherwise useful plants were particularly mentioned. Notes on certain plants of Alaska, a more humid region, were also given.

WILFRED H. OSGOOD,
Secretary.

THE CHEMICAL SOCIETY OF WASHINGTON.

THE 152d regular meeting was held October 13, 1904, at the Cosmos Club. The program for the evening was as follows:

The Action of Ammonium Chloride on Sulphur Tetrachloride. P. FIREMAN.

A Comparison of the Wet and Crucible Fire Methods for the Assay of Gold Tellurides, with Notes on the Errors Incidental to the Operation of the Fire Assay and Parting.

W. F. HILLEBRAND and E. T. ALLEN.

The authors showed that the fire assay for telluride gold ores, with proper precautions, is accurate. Other errors in fire assays, especially the volatility of gold during cupellation and the loss of gold in parting, were investigated. In regard to the former the error

was shown to be much larger than has been formerly supposed. The solubility of gold in nitric and nitrous acid which has been claimed by some authors was shown to be entirely negligible.

An Examination of Lard from Cotton Seed Meal Fed Hogs by the Phytosterin Acetate Method of Bömer. L. M. TOLMAN.

The author examined fifteen samples of lard prepared from hogs which had been fed on cotton seed meal. All of the samples gave positive tests with the Halpen reagent but in none of them could phytosterol be found. This confirmed the work of Solstein. It was found, however, that small amounts of added cotton seed oil could be detected by this method. Also that cotton seed oil that had been heated to destroy the Halpen reaction could be detected.

L. S. MUNSON,
Secretary, pro tem.

THE 153d meeting was held November 10, 1904, at 8 o'clock in the assembly hall of the Cosmos Club. The president, Dr. E. T. Allen, called the meeting to order. After the election of Messrs. H. N. Stokes and S. S. Vorhees as councilors for the ensuing year, the following program was presented:

The first paper, entitled 'Calcium Sulphate in Aqueous Ammonium Sulphate Solution,' was presented by Dr. E. C. Sullivan. The results of the experiments showed that as the concentration of the ammonium sulphate increases the solubility of the calcium sulphate at first diminishes, and then increases. The general appearance of the curve corresponds to that of the solubility of calcium sulphate in sodium sulphate solutions, reported by Cameron at a previous meeting of this society. Conductivity determinations of the solutions seem to show that the concentration of the non-dissociated calcium sulphate does not remain constant.

Under the title of 'A Statistical Analysis of the Chemical Industries of the United States,' Professor Charles E. Munroe reviewed the history of the census of manufactures in the United States, describing briefly the methods for securing and classifying the returns and pointed out that while the sta-

tistics published for the entire manufacturing industries of the country taken as a whole are accurate to a high degree, the statistics for any single industry forming a part of this whole may, owing to the fact that to prevent duplication an establishment manufacturing a variety of products is classified according to that one of its products having the maximum value, be less accurate. He believes that this inaccuracy in presentation may be greatly remedied by a further analysis and segregation of the published data and that this analysis may be so extended as to show the disposition made of the products. This last process appears not to have been heretofore attempted, yet the results should prove to be not only of general interest but of special value in legislation and litigation where the rule of 'principal use' obtains and in manufacturing and other policies where the question of substitution may arise, while in the census work itself this data would furnish additional checks on the returns and the results. Examples of the results of such analyses as pertained to the wood distillation and the sulphuric acid industries were presented.

The last paper of the program, entitled 'Memories of Bunsen and Heidelberg,' was presented by Dr. W. F. Hillebrand. The speaker gave a description of the Heidelberg chemical laboratory as it was conducted by Bunsen thirty years ago. Personal reminiscences and experiences were recalled.

A. SEIDELL,
Secretary.

NEW YORK ACADEMY OF SCIENCES. SECTION OF
BIOLOGY.

At the November meeting Professor Underwood presided. Dr. W. M. Wheeler, of the American Museum of Natural History, was elected chairman, and M. A. Bigelow, of Teachers College, Columbia University, secretary, of the section for the year 1905. Papers were presented by W. E. Kellicott, M. A. Bigelow and F. E. Lloyd.

Dr. Kellicott's paper, on the 'Development of the Venous System of *Ceratodus*,' pointed out many similarities to the amphibian.

These similarities are so numerous and exact that it seems impossible to believe that the Dipnoi and Amphibia have not arisen as a common stock which has separated later into these groups. The adult relations and the mode of development of the vena cava of *Ceratodus* indicate that this vessel is not to be looked upon as one of the hepatic veins which has made a new connection with the posterior cardinal vein, but that its anterior portion develops as a short cut by way of which the blood from the mesonephros may be carried to the heart after the atrophy of the pronephros and the associated veins.

Mr. Bigelow briefly described some observations on eggs of the crustacean *Hippolyte* subjected to slight pressure during cleavage. While the normal cleavage is total, pressure prohibited the formation of cell-boundaries, and unsegmented eggs with 2, 4, 8, 16 and 32 nuclei were obtained. When the pressure was removed the cell-boundaries soon appeared. The cleavage of this egg under pressure exhibits some striking resemblances to the normal superficial cleavage of eggs of allies.

Professor Lloyd described the conditions for botanical research at the Desert Botanical Laboratory in Arizona. Many photographs were exhibited to illustrate descriptions of the peculiar flora in the vicinity of the laboratory and of the method of conducting experiments, especially those concerned with the relation of desert plants to water.

M. A. BIGELOW,
Secretary.

CLEMSON COLLEGE SCIENCE CLUB.

The forty-ninth regular meeting of the Clemson College Science Club was held in the lecture room of the electrical laboratory, October 28, at 8:30 p.m. Dr. J. H. James gave a brief report of the summer meeting of the American Chemical Society, reviewing informally the more important papers. Professor W. M. Riggs gave an account of a new food product, practically a popped rice, prepared by a process invented by Dr. A. P. Anderson, a former member of the Clemson College faculty; and now being exhibited at St. Louis. The principal paper of the evening was by

Dr. F. H. H. Calhoun, who discussed two features of glaciation in the northwestern part of Montana. The first was as to the relative ages of the ice of the Kewatin ice sheet, and the ice of the mountain glaciers. The second dealt with the question of the Albertan drift period. From data gathered in the three river valleys, the conclusion was reached that the mountain ice was the older of the two sheets. In the valley of Birch Creek a valley train from the mountain glacier was found beneath lake deposit formed in front of the Kewatin ice sheet. In the valley of the Two Medicine River, the moraine of the mountain ice was covered by lake deposit, and in the same valley further east, the moraine of the Kewatin ice sheet rested on a valley train from the mountain glacier. In the valley of the Belly River, the mountain drift was found under the Kewatin drift. Dr. Calhoun also arrived at the conclusion that the so-called Albertan drift sheet of Dawson was nothing more than old river gravels picked up by the Kansan ice sheet, and now found at the bottom of that drift sheet. This paper will be published by the U. S. Geological Survey.

HAVEN METCALF,

Secretary.

ONONDAGA ACADEMY OF SCIENCE.

At the last meeting of the Academy, held in Syracuse, N. Y., October 21, Dr. H. C. Cooper addressed the meeting on 'Physical Chemistry and its Service to the Other Sciences.'

Physical chemistry was shown to have an important bearing on physiology in virtue of the application of the modern theory of solution to vital processes and the discovery of the similarity of behavior between enzymes and inorganic contact agents. The work of van't Hoff and his pupils on chemical equilibria in various geological formations, and the determinations of the transition-points of geologically important substances were commended to the study of geologists. The speaker also showed how, by physico-chemical methods, various physiologically and mineralogically important substances have been prepared in the laboratory.

J. E. KIRKWOOD,

Corresponding Secretary.

WELLESLEY COLLEGE SCIENCE CLUB.

THE first regular meeting of the club for the year was held at the Whitin Observatory on October 18. Professor Ellen Hayes presented a paper on 'Nature the Master of Man.'

The second meeting was held in the Physics Lecture Room on November 8. Mr. Albert E. Leach, of the Massachusetts State Board of Health, read a paper on 'The Purity of our Food.'

GRACE E. DAVIS,

Secretary.

DISCUSSION AND CORRESPONDENCE.

DAVENPORT'S 'STATISTICAL METHODS.'

TO THE EDITOR OF SCIENCE: In the preface to the second edition of Dr. C. B. Davenport's useful 'Statistical Methods' occur the following sentences: "Especial attention is called to Table IV., which is an extension of Table IV. of the first edition that was calculated by Professor Frederick H. Safford, and appears to have been the first published table of the normal probability integrals based on the standard deviation. More recently Mr. W. F. Sheppard has published in *Biometrika* a similar table. * * *"

In justice to Mr. Sheppard I wish to point out that his tables in *Biometrika* are only the extension of the table which appears in his memoir read before the Royal Society in 1897 and issued in 1898 (cited by Dr. Davenport, second edition, pp. 84, 101). Dr. Davenport's first edition of his 'Statistical Methods' did not appear until 1899. Thus there can be no claim as to priority for Professor Safford's table of 1899. If we desire to be absolutely accurate in the matter, we shall probably not attribute the first published table even to Mr. Sheppard, still less to Professor Safford. On the other hand, Mr. Sheppard's table at present stands quite unsurpassed for its range, accuracy and the number of decimal places in the probability integral.

KARL PEARSON.

UNIVERSITY COLLEGE, LONDON, ENGLAND,
November 5, 1904.

CORALS.

TO THE EDITOR OF SCIENCE: I find myself in the position of an author replying to a